DOCUMENT RESUME

ED 444 504 IR 020 160

AUTHOR Montgomery, Lee; Whiting, David
TITLE Teachers under Construction--Incorporating Principles of Engaged and Brain Based Learning into a Constructivist "Technology in Education" Program.
PUB DATE 2000-00-00
NOTE 7p.; In: Society for Information Technology & Teacher Education International Conference: Proceedings of SITE 2000 (11th, San Diego, California, February 8-12, 2000). Volumes 1-3; see IR 020 112.
PUB TYPE Reports - Research (143) -- Speeches/Meeting Papers (150)
EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS *Constructivism (Learning); *Cooperative Learning; *Educational Technology; Group Activities; Higher Education; *Instructional Design; Preservice Teacher Education
IDENTIFIERS Engaged Style; Southern Utah University; Technology Integration

ABSTRACT

This paper is a report on the findings of an action research project conducted during an undergraduate "Technology in Education" class for preservice teachers at Southern Utah University. The course was structured using a constructivist approach and designed to incorporate principles of brain-based and engaged learning. A five-step sequence of activities was employed to facilitate the successful operation of collaborative groups: (1) formation of the groups; (2) clarification of the group goal; (3) negotiation of tasks and sub-tasks to be completed; (4) monitoring of individual and group performance; and (5) reconciliation of differences in approaches to the goal. Technology competencies of students participating in the course were accessed using quantitative and qualitative analysis techniques. Findings indicate that students in the constructivist course acquired proficiency in the use of technology and developed knowledge structures essential to the successful integration of technology into classroom practice. (MES)

Reproductions supplied by EDRS are the best that can be made
from the original document.

ED 444 504

Teachers Under Construction—Incorporating Principles of Engaged and Brain Based Learning into a Constructivist "Technology in Education" Program

Lee Montgomery, Ph.D.
College of Education
Southern Utah University
montgomery@suu.edu

G.H. Marks

David Whiting
College of Education
Southern Utah University
whiting@suu.edu

U.S. DEPARTMENT OF EDUCATION
NATIONAL INSTITUTE OF EDUCATION
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

- This document has been reproduced as received from the person or organization originating it.
  Minor changes have been made to improve reproduction quality.
- Points of view or opinions stated in this document do not necessarily represent official NIE position or policy.

Abstract: This paper is a report on the findings of an action research project conducted during an undergraduate "Technology in Education" class for preservice teachers. The course was structured using a Constructivist approach and designed to incorporate principles of brain based and engaged learning. Technology competencies of students participating in the course were accessed using quantitative and qualitative analysis techniques. Findings indicate that students in the Constructivist course acquired proficiency in the use of technology and developed knowledge structures essential to the successful integration of technology into classroom practice.

Rationale and Problem Statement

Trends in pedagogy and technology are converging to significantly alter the learning environment of the coming millennium. Shifts in theory brought about by findings of cognitive psychology and brain based learning research challenge the traditional lecture-exam model of learning and indicate that learning is best facilitated by activities that actively engage learners in the creation of knowledge. The emerging paradigm supports the theory that learning is best achieved by interaction between learners and teachers and between learners and their peers.

Traditionally, educators have attempted to employ technologies to teach students directly. In the lecture/direct instruction model so common in higher education, technologies may be used to deliver and communicate messages to students who, it is assumed, will comprehend these messages and learn from them. The underlying assumption of this old paradigm is that students learn from technology in much the same way they learn from teachers: through the transmission of information. Thus, for many years, technology savvy educators have sought to embed information in technology-based lessons to be transmitted to the learner who becomes little more than a passive recipient of that information. In this fashion, students learn from technology what the technology "knows" just as they learn from the teacher what the teacher knows.

Constructivists, on the other hand, argue that students cannot directly learn from either teachers or technologies. Rather, they maintain, students learn from

IR020160

BEST COPY AVAILABLE

thinking, and thinking, not teachers or technologies, mediates learning. To the Constructivist, thinking can be engaged only through activity. Teachers and technologies can present and support thinking activities, but they cannot directly cause thinking, just as they cannot directly cause learning. Since students learn from thinking about what they are doing, both teachers and technologies can support learning only if they are used as intellectual partners and tools that help learners to think (Jonassen, 1997).

A Constructivist approach to teacher education is essential if the next generation of teachers are to encourage students in their classrooms to apply, analyze, synthesize evaluate and construct knowledge from the massive flow of information available in today's society. White (1996) and other teacher educators have long recognized the importance of engaging preservice teachers in these processes throughout the teacher education program. But in spite of a growing body of research supporting the benefits of Constructivist pedagogy, most technology in education courses continue to follow the transmission model of instruction.

The "Technology in Education" course required of preservice teachers at many institutions typically follows a direct instruction model which emphasizes rote learning of computing skills rather than the integration of those skills in meaningful instructional contexts. Consequently, students often emerge from traditional programs knowing how to perform basic tasks such as using the Internet or constructing a database but lacking the conceptual understanding necessary to know how, when and where to integrate these technologies into their own professional practice. The dilemma facing educators charged with providing technology education to future teachers is how to restructure traditional skills-based courses so that students not only acquire the requisite skills but also construct the knowledge base necessary to apply those skills to support engaged learning in their own classrooms with their own students.

Program Description

In response to this dilemma, Montgomery and Whiting, both professors of teacher education at Southern Utah University, have attempted to develop a technology in education program informed by Constructivist principles and grounded in brain based and engaged learning theory. In developing a pilot program for undergraduate and graduate students, the researchers adopted a framework suggested by Brooks and Brooks (1993) which incorporates a set of twelve Constructivist teaching behaviors. This set of descriptors outlined below presents teachers as mediators of students and environments rather than as providers of information and managers of behavior.

1. Constructivist teachers encourage and accept student autonomy and initiative.

2. Constructivist teachers use raw data and primary sources, along with manipulative, interactive and physical materials.

3. When framing tasks, Constructivist teachers use cognitive terminology such as "classify," "analyze," "predict," and "create."

4. Constructivist teachers allow student responses to drive lessons, shift instructional strategies, and alter content.

5. Constructivist teachers inquire about students' understanding of concepts before sharing their own understandings of those concepts.

6. Constructivist teachers encourage students to engage in dialogue, both with the teacher and with one another.

7. Constructivist teachers encourage student inquiry by asking thoughtful, open-ended questions and encouraging students to ask questions of each other.

8. Constructivist teachers seek elaboration of students' initial responses.

9. Constructivist teachers engage students in experiences that might engender contradictions to their initial hypotheses and then encourage discussion.

10. Constructivist teachers allow wait time after posing questions.

11. Constructivist teachers provide time for students to construct relationships and create metaphors.

12. Constructivist teachers nurture students' natural curiosity through frequent use of the learning cycle model.

Atkin and Karplus (1962) described the process of curriculum development and instruction as a three step cycle. First, the instructor provides an open-ended opportunity for students to interact with purposefully selected materials. The primary goal of this initial "discovery" lesson is for students to generate questions and hypotheses from working with the materials. Next, the teacher provides the "concept introduction" lesson aimed at focusing the students' questions, providing related new vocabulary, framing with students their proposed laboratory experiences, and so forth. The third step, "concept application," completes the cycle. During this phase, students work on new problems with the potential for evoking a fresh look at the concepts previously studied.

The learning cycle represents a significant departure from the ways in which most teachers are taught to teach. In the traditional model, emphasized in traditional approaches to curriculum and instruction, concept introduction comes first, followed by concept application activities. Discovery, if addressed at all, usually occurs after introduction and application activities , and includes only the more capable students who finish their application tasks before the rest of the class.

To facilitate a learning environment consistent with the principles outlined above, Montgomery and Whiting developed a series of experiences which emphasize collaborative and project based learning. To provide an authentic context for learning, students work collaboratively in small groups to develop a detailed plan for a technology rich charter school. Students employ a variety of "mind tools" (Jonassen, 1996) including modeling and interactive multimedia software to develop plans which emphasize engaged learning and the appropriate integration of instructional technologies. In the course of completing the project, learners utilize the Internet and other resources to explore the literature of educational reform and the effectiveness of instructional technologies and to expand their knowledge of curriculum and instruction. The groups use spreadsheets and databases to analyze information and produce model curriculum materials using multimedia and desktop publishing tools. During the last two weeks of class, each group presents its plan using appropriate technologies and participates in a self and peer assessment process. Conclusions and reflections on experiences are published on a student produced web site.

Because knowledge construction is facilitated by collaboration, the formation of collaborative "pods" or groups was an important dimension of the restructured program. To create a learning environment which emphasizes multiple perspectives, peer support and cognitive apprenticeship, the researchers adapted a model of collaborative learning suggested by Kagan (1990). A five step sequence of activities was employed to facilitate the successful operation of the collaborative pods.

1. Formation of the groups. Students were asked to group themselves into pods of three to five on the basis of a shared vision for the proposed charter school. Since the school was to represent an integrated approach to curriculum the composition of each group was interdisciplinary. In addition to developing a charter school proposal, student subject area specialists were given the task of working together to plan cross-discipline instructional units which would facilitate engaged learning through the appropriate use of various instructional technologies.

2. Clarification of the group goal. The common thread of the content to be explored was the creation of a hypothetical charter school based on the principles of Constructivism, and consistent with the latest research findings on brain based and engaged learning. Each pod was given the task of utilizing various mind tools to create a portfolio representing their school and its curriculum. An integral part of the portfolio was a Unit of Practice and a model lesson based on Constructivist principles. Each group was also assigned the responsibility of conducting a whole group learning experience near the end of the course designed to bring closure to the research process and to share constructed knowledge.

3. Negotiation of tasks and sub tasks to be completed. Students were asked to break down the required tasks and to delegate them to various pod members. An important dimension of this process was the determination by the group of which tasks should be delegated to individuals and which should be accomplished in group brainstorming and problem-solving settings. In addition, each group member was asked to master one of the "mind tools" (Inspiration, Avid Cinema, ClarisWorks, Claris Home page, Powerpoint and Hyperstudio) and assume responsibility for teaching others in the pod to use it.

4. Monitoring of individual and group performance. Individual and group progress was monitored using process rubrics and periodic reports. Each pod was asked to share research findings and works in progress on a weekly basis with members of other groups and with the instructor. Pod members were also asked to complete weekly self-assessments designed to track mastery of technology competencies related to the use of the various mind tools. These assessments were compared to benchmarks established in individual skills development plans completed by each pod member at the beginning of the course.

5. Reconciliation of differences in approaches to the goal. Disagreements in approaches to and interpretations of group tasks and goals sometimes arose, giving pod members opportunities to articulate their unique perspectives and to negotiate differences in understanding. Interpersonal communication skills including providing and receiving feedback, paraphrasing without evaluating, negotiating meaning, and accepting the needs of others were introduced by the instructors and presented as an integral part of the cooperative process.

Findings and Conclusions

Qualitative and quantitative data were gathered during and at the conclusion of the course. These measures included concept maps of content knowledge, self-assessment forms related to skills acquisition, group process forms and self and peer ratings of final presentations. In addition, a course evaluation was completed by all students participating in the program.

Analysis of the various measures yielded a number of positive results. All students participating in the course demonstrated mastery of the various "mind tools" and responded positively to the processes of collaborative, project-based learning. A significant number of students indicated that participation in the course helped them to develop problem solving and critical thinking skills. In addition, they reported gains in understanding of the collaborative research process and in their perceived ability to facilitate and teach in a constructivist environment.

On the basis of these results, the researchers conclude that students in constructivist environments can effectively learn the same technical skills emphasized in transmissive approaches to technology education. Further, the introduction of collaborative learning and an inquiry driven curriculum can greatly enhance and

accelerate the acquisition of these technical skills while increasing student interest and motivation.

The new paradigm brings with it an innovative model of teaching and learning that emphasizes the construction rather than the transmission of knowledge.The use of technology and collaboration needs to be encouraged more than ever in higher education in order to prepare teachers for the paradigm shift they will experience as more and more schools embrace the principles of brain based and engaged learning. Consequently, educators at the college and university level must model new approaches which emphasize the role of teacher as facilitator of learning rather than dispenser of information. Only through this approach will prospective teachers acquire the competencies which will be the mainstay of the educator in the new millennium.

References

Atkin, J.M. & R. Karplus (1962). "Discovery or Invention?" Science Teacher. 29 (5), 45.

Brooks, Jacqueline & Martin G. (1993). *The case for constructivist classrooms.* Alexandria, VA: Association for Supervision and Curriculum Development. 101-118.

Jonassen, David H. (1996). *Computers in the classroom: Mindtools for critical thinking*. New Jersey: Prentice Hall Inc., 9-11.

Kagan, S. (1990) Cooperative learning: Resources for teachers. San Juan Capistrano, CA: Resources for Teachers.

White, C. (1996). Merging technology and constructivism in teacher education. *Journal of the Texas Association of Colleges for Teacher Education.* 12 (1), 62-70.